Journal of Biomedical Materials Research

Volume 24, 1990

Editor-in-Chief: JAMES M. ANDERSON

Assistant Editors:

Jonathan Black
Robert Craig
Harry B. Skinner
Buddy Ratner
Allan Weinstein

Editorial Board:

Josephe Andrade
K. J. Anusavice
Robert E. Baier
P. K. Bajpai
Sumner Barenberg
J. D. Bobyn
Jack D. Bokros
J. W. Boretos
John Brunski
Atter S. Chawla
Milos Chvapil
Francis W. Cooke
Stephen Cook
S. L. Cooper
Paul Ducheyne
Robert Draughn
P. Elain Duncan
Jan Feijen
Henry Gabelnick
Lawrence Gettleman
Peter Griss
U. Gross
Thomas A. Gruen
Robert Guidoin
C. Willian Hall
S. R. Hanson
Larry Hench
Anne Hiltner
Allan S. Hoffman
Thomas Horbett
Samuel F. Hulbert
Robert A. James
Lawrence Katz
Haruyuki Kawahara
E. P. Lautenschlager
Clive A. J. Lee
Jack E. Lemons
Donald J. Lyman
Roger E. Marchant
Ivar A. Mjör
Joon B. Park
Ralph W. Phillips
R. M. Pilliar
Hanns Plenk
Solomon Pollack
B. A. Rahn
Fredric Rhinelander
S. Saha
Theodore Schilb
Fredrick J. Schoen
V. Sevastyanov
Dennis Smith
V. Soltesz
Myron Spector
T. K. Vaidyanathan
Andreas von Recum
Leo Vroman
June Wilson
I. V. Yannas

Assistant to the Editor:

Bonnie Berry

Editorial Production, John Wiley:

Merilee Croft

The Official Journal of The Society for Biomaterials, and The Japanese Society for Biomaterials

an Interscience® Publication published by **JOHN WILEY & SONS**

Journal of Biomedical Materials Research (ISSN: 0021-9304) is published monthly by John Wiley & Sons, Inc. Copyright © 1990 by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. All rights reserved. Reproduction or translation of any part of this work beyond that permitted by Sections 107 or 108 of the United States Copyright Law without the permission of the copyright owner is unlawful. Second-class postage paid at New York, NY, and at additional mailing offices.

The code and the copyright notice appearing at the bottom of the first page of an article in this journal indicate the copyright holder's consent that copies may be made for personal or internal use, or for the personal or internal use of specific clients, on the condition that the copier pay for copying beyond that permitted by Sections 107 or 108 of the United States Copyright Law. The per-copy fee for each item is $4.00 and is to be paid through the Copyright Clearance Center, Inc., 21 Congress St., Salem, MA 01970. (The fee for articles published prior to 1978 is $1.00 per article.) This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Such permission requests and other permission inquiries should be addressed to the Permissions Dept.

Subscription price (1990): $475.00 per volume. Outside U.S.A.: $577.00 (air service and handling included). Back volumes, microfilm, and microfiche are available for previous years. Request price list from Publisher. Please allow four weeks for processing a change of address. For subscription inquiries, please call customer service at (212) 850-6645 or write to the above address.

Claims for undelivered copies will only be accepted after the following issue has been received. Please enclose a copy of the mailing label or cite your subscriber reference number in order to expedite handling. Missing copies will be supplied when losses have been sustained in transit and where reserve stock will permit.

Postmaster: Send address changes to *Journal of Biomedical Materials Research,* Susan Malawski, Fulfillment Manager, Subscription Department, John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158.

Advertising/Reprints: Inquires concerning advertising and reprints should be forwarded to Ms. Tasi Manicas, Advertising/Reprints Sales, John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158, (212) 850-6763. Advertising Sales, European Contact: Michael Levermore, Advertising Manager, John Wiley & Sons, Ltd., Baffins Lane, Chichester, Sussex PO19 1UD, England.

Other correspondence: Address all other correspondence to: *Journal of Biomedical Materials Research,* Publisher, Interscience Division, Professional, Reference, and Trade Group, John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158.

Manuscripts and correspondence concerning manuscripts under review should be sent to the Editor. *Information for Contributors* appears in the first and last issue of each volume.

Journal of Biomedical Materials Research

Volume Contents 1990

Issue 1, January 1990

Thermodynamic study of phase transfer of precipitates on SiC whisker reinforced glass ceramics
K. Imai, T. Yuge, S. Ito, T. Kawase, and S. Saito 1

Apatite–wollastonite containing glass ceramic granule–fibrin mixture as a bone graft filler: Use with low granular density
K. Ono, T. Yamamuro, T. Nakamura, and T. Kokubo 11

Immobolization and characterization of β-galactosidase in thermally reversible hydrogel beads
T. G. Park and A. S. Hoffman 21

Exclusion of uropathogen adhesion to polymer surfaces by *Lactobacillus acidophilus*
L. A. Hawthorn and G. Reid..... 39

Mechanical properties of bone after implantation of apatite–wollastonite containing glass ceramic–fibrin mixture
K. Ono, T. Yamamuro, T. Nakamura, and T. Kokubo 47

Modified ethoxyethyl cyanoacrylate for therapeutic embolization of arteriovenous malformation
Y.-C. Tseng, S.-H. Hyon, Y. Ikada, W. Taki, A. Uno, and Y. Yonekawa 65

The effects of heat treatments and bead size on the corrosion of porous F75 in saline and serum
P. J. Hughes, S. A. Brown, J. H. Payer, and K. Merritt 79

Sepsis of vascular catheters. II. *In vitro* disinfection of colonized tubing
M. B. Dennis Jr., D. R. Jones, and F. C. Tenover 95

Series shunt evaluation of polyurethane vascular graft materials in chronically AV-shunted canines
T. J. McCoy, H. D. Wabers, and S. L. Cooper 107

Announcements 131

Information for Contributors 133

Issue 2, February 1990

A fractographic analysis of *in vivo* poly(methyl methacrylate) bone cement failure mechanisms
L. D. T. Topoleski, P. Ducheyne, and J. M. Cuckler 135

Surface passivation by human albumin of plasmapheresis circuits reduces platelet accumulation and thrombus formation. Experimental and clinical studies
J. N. Mulvihill, A. Faradji, F. Oberling, and J.-P. Cazenave 155

The influence of calcium phosphate biomaterials on human bone cell activities. An *in vitro* approach
M. Grégoire, I. Orly, and J. Menanteau 165

Use of the acyl azide method for cross-linking collagen-rich tissues such as pericardium
H. Petite, I. Rault, A. Huc, Ph. Menasche, and D. Herbage 178

Cyclic fatigue-crack propagation, stress-corrosion, and fracture-toughness behavior in pyrolytic carbon-coated graphite for prosthetic heart valve applications
R. O. Rotchie, R. H. Dauskart, W. Yu, and A. M. Brendzel 189

In vitro biocompatibility of polyetheretherketone and polysulfone composites
L. M. Wenz, K. Merritt, S. A. Brown, A. Moet, and A. D. Steffee . 207

A new porous polyetherurethane wound covering
P. Bruin, M. F. Jonkman, H. J. Meijer, and A. J. Pennings 217

Adsorption of plasma proteins and adhesion of platelets onto novel polyetherurethaneureas—relationship between denaturation of adsorbed proteins and platelet adhesion
Y. Ito, M. Sisido, and Y. Imanishi 227

Preparation of spherical encapsulation of activated carbons and their adsorption capacity of typical uremic toxins
C.-J. Lee and S.-T. Hsu 243

Analysis of A · W glass-ceramic surface by micro-beam x-ray diffraction
T. Kitsugi, T. Yamamuro, and T. Kokubo 259

Announcements 275

Information for Contributors .....

Issue 3, March 1990

Tissue/biomaterial interface characteristics of four elastomers. A transmission electron microscopical study
D. Bakker, C. A. van Blitterswijk, S. C. Hesseling, W. Th. Daems, and J. J. Grote 277

Tissue response to percutaneous implants in rabbits
J. A. Jansen, J. P. C. M. van der Waerden, H. B. M. van der Lubbe, and K. de Groot 295

Surface modification of biomaterials through noble metal ion implantation
R. A. Buchanan, I.-S. Lee, and J. M. Williams 309

Bactericidal properties of a titanium-peroxy gel obtained from metallic titanium and hydrogen peroxide
P. Tengvall, E. G. Hörnsten, H. Elwing, and I. Lundström 319

Ca, P-rich layer formed on high-strength bioactive glass-ceramic A–W
T. Kokubo, S. Ito, Z. T. Huang, T. Hayashi, S. Sakka, T. Kitsugi, and T. Yamamuro 331

Effect of alternative crosslinking methods on the low strain rate viscoelastic properties of bovine pericardial bioprosthetic material
C. A. Pereira, J. M. Lee, and S. A. Haberer 345

Cytotoxicity testing of wound dressings using normal human keratinocytes in culture
M. Rosdy and L.-C. Clauss 363

Macroporous calcium phosphate ceramic for long bone surgery in humans and dogs. Clinical and histological study
G. Daculsi, N. Passuti, S. Martin, C. Deudon, R. Z. Legeros, and S. Raher 379

Announcement 397

Information for Contributors 399

Issue 4, April 1990

Poly(dimethylsiloxane)-poly(ethylene oxide)-heparin block copolymers II: Surface characterization and *in vitro* assessments
D. W. Grainger, K. Knutson, S. W. Kim, and J. Feijen 403

The biocompatibility of hydroxyapatite ceramic: A study of retrieved human middle ear implants
C. A. van Blitterswijk, S. C. Hesseling, J. J. Grote, H. K. Koerten, and K. de Groot 433

Fibrinogen–aluminium interaction: Changes with oxide layer thickness onto metal surface
M. C. Sunny and C. P. Sharma 455

The influence of hydrogel functional groups on cell behavior
K. Smetana, Jr., J. Vacík, D. Součková, Z. Krčová, and J. Šulc 463

Surface reactions of calcium phosphate ceramics to various solutions
K. Hyakuna, T. Yamamuro, Y. Kotoura, M. Oka, T. Nakamura, T. Kitsugi, T. Kokubo, and H. Kushitani 471

Biocompatibility of a polyether urethane, polypropylene oxide and a polyether polyester copolymer. A qualitative and quantitative study of three alloplastic tympanic membrane materials in the rat middle ear
D. Bakker, C. A. van Blitterswijk, S. C. Hesseling, H. K. Koerten, W. Kuijpers, and J. J. Grote 489

The histological effects of the implantation of different sizes of polyethylene particles in the rabbit tibia
S. B. Goodman, V. L. Fornasier, J. Lee, and J. Kei 517

Information for Contributors 525

Issue 5, May 1990

Enzymatic activity toward poly(L-lactic acid) implants
J. M. Schakenraad, M. J. Hardonk, J. Feijen, I. Molenaar, and P. Nieuwenhuis 529

Poly(dimethylsiloxane)-poly(ethylene oxide)-heparin block copolymers, III: Surface and bulk compositional differences
D. W. Grainger, T. Okano, S. W. Kim, D. G. Castner, B. D. Ratner, D. Briggs, and Y. K. Sung 547

Effect of vacuum mixing on the mechanical properties of antibiotic-impregnated polymethylmethacrylate bone cement[2]
M. J. Askew, M. F. Kufel, P. R. Fleissner, Jr., I. A. Gradisar, Jr., S.-J. Salstrom, and J. S. Tan 573

The effect of γ-irradiation on collagen molecules, isolated α-chains, and crosslinked native fibers
D. T. Cheung, N. Perelman, D. Tong, and M. E. Nimni 581

Stress enhancement and fatigue susceptibility of porous coated Ti-6Al-4V implants: an elastic analysis
P. B. Messersmith and F. W. Cooke 591

Characterization of alkyl grafted polyurethane block copolymers by variable takeoff angle X-ray photoelectron spectroscopy
T. G. Grasel, D. G. Castner, B. D. Ratner, and S. L. Cooper 605

Cellular interactions with biomaterials: *in vivo* cracking of pre-stressed Pellethane 2363-80A
Q. Zhao, M. P. Agger, M. Fitzpatrick, J. M. Anderson, A. Hiltner, K. Stokes, and P. Urbanski 621

Issue 6, June 1990

Investigation of a hydroxyapatite and calcium sulfate composite supplemented with an osteoinductive factor
C. J. Damien, J. R. Parsons, J. J. Benedict, and D. S. Weisman 639

X-ray diffraction studies on plasma-sprayed calcium phosphate-coated implants
B. Koch, J. G. C. Wolke, and K. de Groot 655

The behavior of alloplastic tympanic membranes in *Staphylococcus aureus*-induced middle ear infection. I. Quantitative biocompatibility evaluation
D. Bakker, C. A. van Blitterswijk, S. C. Hesseling, W. Th. Daems, W. Kuijpers, and J. Grote 669

Tissue reaction to subcutaneous implantation of a collagen sponge. A histological, ultrastructural, and immunological study
K. Anselme, C. Bacques, G. Charriere, D. J. Hartmann, D. Herbage, and R. Garrone 689

Acrylated phosphonate esters containing 1,3-dioxane and 1,3-dioxane moieties as adhesion-promoting agents for dentin and hard tissues, I
I. Cabasso and S. Sahni 705

Solutions able to reproduce *in vivo* surface-structure changes in bioactive glass-ceramic A-W[3]
T. Kokubo, H. Kushitani, S. Sakka, T. Kitsugi, and T. Yamamuro .. 721

Micromechanical spectroscopy of cartilage proteoglycans: Hydration
A. Lamure, M.-F. Harmand, and C. Lacabanne 735

Development and testing of a human collagen graft material
D. Quteish, G. Singh, and A. E. Dolby 749

Small-caliber polyurethane and polytetrafluoroethylene grafts: A comparative study in a canine aortoiliac model
T. E. Brothers, J. C. Stanley, W. E. Burkel, and L. M. Graham 761

Porcine aortic valve bioprostheses: A morphologic comparison of the effects of fixation pressure
S. L. Hilbert, M. K. Barrick, and V. J. Ferrans 773

Issue 7, July 1990

Preliminary characterization of bioresorbable and nonresorbable synthetic fibers for the repair of soft tissue injuries
S.-J. Shieh, M. C. Zimmerman, and J. R. Parsons 789

The behavior of alloplastic tympanic membranes in *Staphylococcus aureus*-induced middle ear infection. II. Morphological study of epithelial reactions
D. Bakker, C. A. van Blitterswijk, S. C. Hesseling, W. Th. Daems, and J. J. Grote 809

Histological and ultrastructural appearance of the hydroxyapatite–bone interface
G. L. De Lange, C. De Putter, and F. L. J. A. De Wijs 829

Difference in tissue response to nitrogen-ion-implanted titanium and c.p. titanium in the abdominal wall of the rat
T. Röstlund, P. Thomsen, L. M. Bjursten, and L. E. Ericson 847

Study of the effect of the surface state on the cytocompatibility of a Co-Cr alloy using human osteoblasts and fibroblasts
A. Naji and M.-F. Harmand 861

Stiffness and strength tailoring of a hip prosthesis made of advanced composite materials
F.-K. Chang, J. L. Perez, and J. A. Davidson 873

Ectopic induction of cartilage and bone by water-soluble proteins from bovine bone using a polyanhydride delivery vehicle
P. A. Lucas, C. Laurencin, G. T. Syftestad, A. Domb, V. M. Goldberg, A. I. Caplan, and R. Langer 901

Suspension polymerization of 2-hydroxyethyl methacrylate in the presence of polymeric diluents: a novel route to spherical highly porous beads for biomedical applications
A. Jayakrishnan and B. C. Thanoo 913

Tissue reactivity and degradation patterns of absorbable vascular ligating clips implanted in peritoneum and rectus fascia
N. Chegini, S. A. Metz, and B. J. Masterson 929

In vitro and *in vivo* studies of heparinized-collageno-elastic tubes
F. Senatore, H. Shankar, J.-H. Chen, S. Avantsa, M. Feola, R. Posteraro, and E. Blackwell 939

Study of soft tissue ingrowth into canine porous coated femoral implants designed for osteosarcomas management
M. LaBerge, J. D. Bobyn, C. H. Rivard, G. Drouin, and P. Duval 959

Announcement 973

Information for contributors 975

Issue 8, August 1990

Release and detection of dental corrosion products *in vivo*: Development of an experimental model in rabbits
N. Reuling, W. Wisser, A. Jung, and H. O. Denschlag 979

Preparation and evaluation of radiopaque hydrogel microspheres based on PHEMA/iothalamic acid and PHEMA/iopanoic acid as particulate emboli
A. Jayakrishnan, B. Chithambara Thanoo, K. Rathinam, and M. Mohanty 993

In vitro degradation of glycine/DL-lactic acid copolymers
J. Helder, P. J. Dijkstra, and J. Feijen 1005

Detection of surface-adsorbed (lipo)proteins by means of a two-step enzyme-immunoassay: A study on the Vroman effect
A. Poot, T. Beugeling, W. G. van Aken, and A. Bantjes 1021

Dynamic mechanical properties of multiphase acrylic systems
H. Øysæd 1037

Mechanical property studies of human gallstones
S. K. Stranne, F. H. Cocks, and R. Gettliffe 1049

Differential effects of eight metal ions on lymphocyte differentiation antigens *in vitro*
I. Bravo, G. S. Carvalho, M. A. Barbosa, and M. de Sousa 1059

Reduced thrombogenicity of polymers having phospholipid polar groups
K. Ishihara, R. Aragaki, T. Ueda, A. Watenabe, and N. Nakabayashi 1069

Hard tissue replacement (HTR) polymer as an implant material
M. H. Amler and R. Z. LeGeros 1079

Adhesive bonding of denture base resins to plastic denture teeth
S. Suzuki, M. Sakoh, and A. Shiba 1091

Technical Notes

In vitro properties of crosslinked, reconstituted collagen sheets
M. J. Morykwas 1105

Breakdown corrosion potential of ceramic coated metal implants
K. Hayashi, I. Noda, K. Uenoyama, and Y. Sugioka 1111

Information for contributors 1115

Issue 9, September 1990

A new canine model to evaluate the biological response of intramedullary bone to implant materials and surfaces
J. M. Spivak, J. L. Ricci, N. C. Blumenthal, and H. Alexander 1121

Blood compatibility of PEO grafted polyurethane and HEMA/styrene block copolymer surfaces
C. Nojiri, T. Okano, H. A. Jacobs, K. D. Park, S. F. Mohammad, D. B. Olsen, and S. W. Kim 1151

Sequential polydepsipeptides as biodegradable carriers for drug delivery systems
M. Yoshida, M. Asano, M. Kumakura, R. Katakai, T. Mashimo, H. Yuasa, K. Imai, and H. Yamanaka 1173

Biochemical changes and cytotoxicity associated with the degradation of polymeric glutaraldehyde derived crosslinks
L. L. H. Huang-Lee, D. T. Cheung, and M. E. Nimni 1185

Titanium-coated micromachined grooves of different dimensions affect epithelial and connective-tissue cells differently *in vivo*
B. Chehroudi, T. R. L. Gould, and D. M. Brunette 1203

Macromolecular release from collagen monolithic devices
D. L. Gilbert and S. W. Kim 1221

Microencapsulation of mammalian cells in a HEMA-MMA copolymer: Effects on capsule morphology and permeability
C. A. Crooks, J. A. Douglas, R. L. Broughton, and M. V. Sefton 1241

Issue 10, October 1990

Postadsorptive transitions in fibrinogen: Influence of polymer properties
R. J. Rapoza and T. A. Horbett 1263

The bone–titanium interface *in vitro*
J. E. Davies, B. Lowenburg, and A. Shiga 1289

Modulation of cell adhesion by modification of titanium surfaces with covalently attached self-assembled monolayers
C. N. Sukenik, N. Balachander, L. A. Culp, K. Lewandowska, and K. Merritt 1307

The effect of protein and urine on uropathogen adhesion to polymer substrata
L. Hawthorn and G. Reid 1325

The effect of fluid shear stress upon cell adhesion to fibronectin-treated surfaces
G. A. Truskey and J. S. Pirone 1333

In vitro toxicity test of 2-cyanoacrylate polymers by cell culture method
Y.-C. Tseng, Y. Tabata, S.-H. Hyon, and Y. Ikada 1355

Platelet adhesion onto the Langmuir-Blodgett film of poly (γ-benzyl L-glutamate)-poly(ethylene oxide)-poly(γ-benzyl L-glutamate) block copolymer
C. S. Cho, T. Takayama, M. Kunou, and T. Akaike 1369

Study of the mineral–organic linkage in an apatitic reinforced bone cement
J. Dandurand, V. Delpech, A. Lebugle, A. Lamure, and C. Lacabanne 1377

In vivo thrombus formation induced by complement activation on polymer surfaces
K. Hayashi, H. Fukumura, and N. Yamamoto 1385

Rapidly degraded terpolymers of dl-lactide, glycolide, and *e*-caprolactone with increased hydrophilicity by copolymerization with polyethers
A. S. Sawhney and J. A. Hubbell 1397

Issue 11, November 1990

The wear behavior of ion-implanted Ti-6Al-4V against UHMW polyethylene
H. A. McKellop and T.V. Röstlund 1413

Adherence of HDPE powder coating on Co-Cr surfaces: Effect of substrate preparation and gas sterilization
M. LaBerge, G. Drouin, C. Gélinas, B. Champagne, and J. D. Bobyn 1427

Quantitative *in vivo* studies of hyperemia in the course of the tissue response to biomaterial implantation
T. Bouet, M. Schmitt, C. Desuzinges, and R. Eloy 1439

Poly(anhydride) administration in high doses *in vivo*: Studies of biocompatibility and toxicology
C. Laurencin, A. Domb, C. Morris, V. Brown, M. Chasin, R. McConnell, N. Lange, and R. Langer 1463

A parametric study of the factors affecting the fatigue strength of porous coated Ti-6Al-4V implant alloy
D. H. Kohn and P. Ducheyne 1483

Friction properties of the interface between porous-surfaced metals and tibial cancellous bone
D. Rancourt, A. Shirazi-Adl, G. Drouin, and G. Paiement 1503

A hydrophilic plasma polymerized film composite with potential application as an interface for biomaterials
R. E. Marchant, S. D. Johnson, B. H. Schneider, M. P. Agger, and J. M. Anderson 1521

The effects of bulk versus particulate titanium and cobalt chrome alloy implanted into the rabbit tibia
S. B. Goodman, V. L. Fornasier, J. Lee, and J. Kei 1539

Exposure to mercury vapor during setting, removing, and polishing amalgam restorations
Y. Haikel, P. Gasser, P. Salek, and J.C. Voegel 1551

Announcements 1559

Information for contributors 1561

Issue 12, December 1990

Marrow cell induced osteogenesis in porous hydroxyapatite and tricalcium phosphate: A comparative histomorphometric study of ectopic bone formation
H. Ohgushi, M. Okumura, S. Tamai, E.C. Shors, and A.I. Caplan .. 1563

The effect of glass–ceramic implants on matrix vesicle calcification after two weeks of rat tibial bone healing
C. Müller-Mai, D. Amir, H. Wendland, Z. Schwartz, J. Sela, and U. Gross 1571

Compositional analysis of Biomer
J. Belisle, S.K. Maier, and J.A. Tucker 1585

Amount and surface structure of albumin adsorbed to solid substrata with different wettabilities in a parallel plate flow cell
H.M.W. Uyen, J.M. Schakenraad, J. Sjollema, J. Noordmans, W.L. Jongebloed, I. Stokroos, and H.J. Busscher 1599

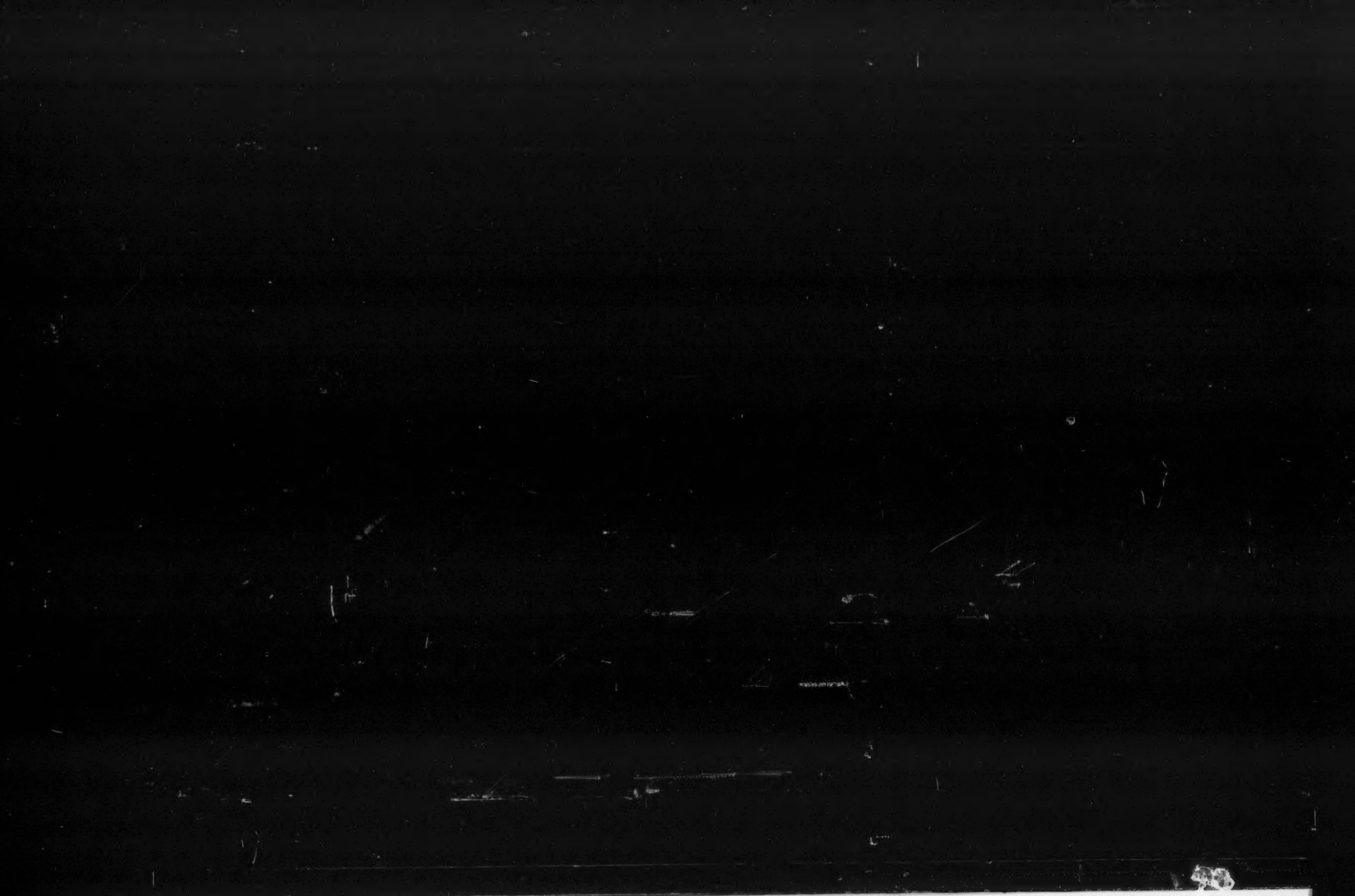
A histomorphological study on self-reinforced polyglycolide (SR-PGA) osteosynthesis implants coated with slowly absorbable polymers
J. Vasenius, S. Vainionpää, K. Vihtonen, M. Mero, A. Mäkelä, P. Törmälä, and P. Rokkanen 1615

Radiofrequency plasma deposition of oxygen-containing films on polystyrene and poly(ethylene terephthalate) substrates improves endothelial cell growth
S.I. Ertel, B.D. Ratner, and T.A. Horbett 1637

Impact resistance of highly crosslinked plastic denture teeth
S. Suzuki, M. Sakoh, and A. Shiba 1661

Author Index to Volume 24 1673

Subject Index to Volume 24 1681

Information for Contributors 1685

Volume Contents iii